Voting, Success, and Superstars

Principles of Complex Systems
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Outline

Where do superstars come from?

Rosen (1981): "The Economics of Superstars" [5]

Examples:

- Full-time Comedians (≈ 200)
- Soloists in Classical Music
- Economic Textbooks (the usual myopic example)

- Highly skewed distributions again...

Superstars

Rosen's theory:

- Individual quality q maps to reward $R(q)$
- $R(q)$ is 'convex' ($d^2R/dq^2 > 0$)
- Two reasons:
  1. Imperfect substitution:
     A very good surgeon is worth many mediocre ones
  2. Technology:
     Media spreads & technology reduces cost of reproduction of books, songs, etc.
- Joint consumption versus public good
- No social element—success follows 'inherent quality'

Superstars

Adler (1985): "Stardom and Talent" [1]

- Assumes extreme case of equal 'inherent quality'
- Argues desire for coordination in knowledge and culture leads to differential success
- Success can be purely a social construction
- (How can we measure 'inherent quality'?)

Voting

Evidence from the web suggestions (Huberman et al.)

1. Easy decisions (yes/no) lead to bandwagoning
   - e.g. jyte.com
2. More costly evaluations lead to oppositional votes
   - e.g. amazon.com

- Self-selection: Costly voting may lower incentives for those who agree with the current assessment and increase incentives for those who disagree.

Voting

Score-based voting versus rank-based voting:

- Balinski and Laraki [2]
  "A theory of measuring, electing, and ranking"
  Proc. Natl. Acad. Sci., pp. 8720–8725 (2007)

Voting

Laureti et al. (2004): "Aggregating partial, local evaluations to achieve global ranking" [4]

- Model: participants rank n objects based on underlying quality q
- Assume evaluation of object i is a random variable with mean q_i
- Choose objects based on votes:

$$p_i(t) \propto v_i(t)^\alpha \text{ or } p_i(t) \propto q_i v_i(t)^\alpha.$$

- If $\alpha < 1$, correct quality ordering is uncovered
- If $\alpha > 1$, some objects are never evaluated and mistakes are made...
- Related to Adler's approach

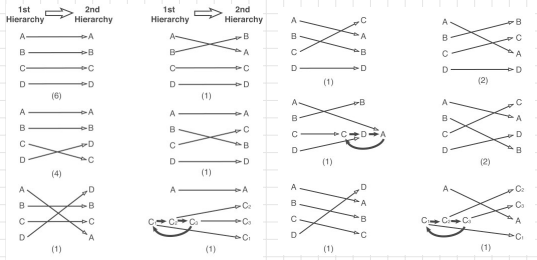
Dominance hierarchies

Chase et al. (2002): "Individual differences versus social dynamics in the formation of animal dominance hierarchies" [3]
The aggressive female Metriaclima zebra:

Pecking orders for fish...

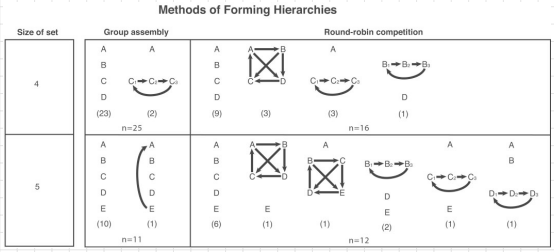
Dominance hierarchies

- Fish forget—changing of dominance hierarchies:



- 22 observations: about 3/4 of the time, hierarchy changed

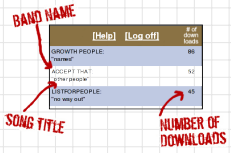
Dominance hierarchies



- Group versus isolated interactions produce different hierarchies

Music Lab Experiment

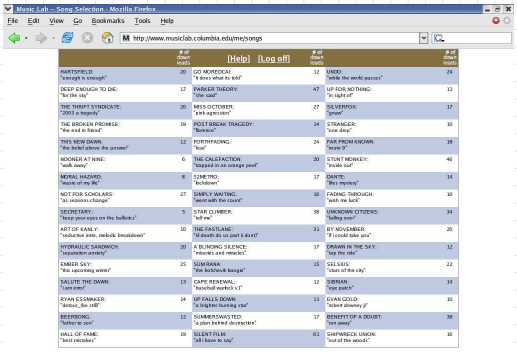
48 songs
30,000 participants



multiple 'worlds'
Inter-world variability

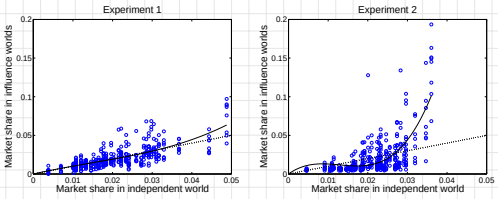
- How probable is the world?
- Can we estimate variability?
- Superstars dominate but are unpredictable. Why?

Music Lab Experiment



Salganik et al. (2006) "An experimental study of inequality and unpredictability in an artificial cultural market" [6]

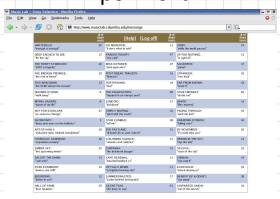
Music Lab Experiment



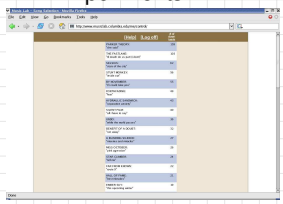
- Variability in final number of downloads.

Music Lab Experiment

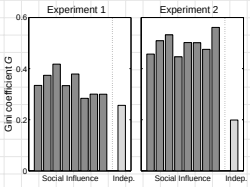
Experiment 1



Experiments 2–4



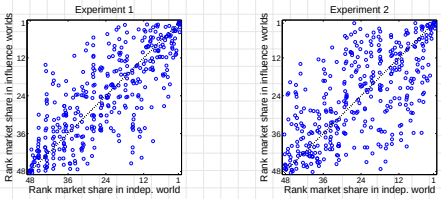
Music Lab Experiment



- Inequality as measured by Gini coefficient:

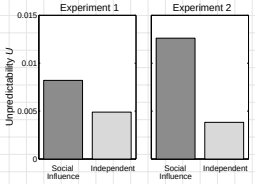
$$G = \frac{1}{(2N_s - 1)} \sum_{i=1}^{N_s} \sum_{j=1}^{N_s} |m_i - m_j|$$

Music Lab Experiment



- Variability in final rank.

Music Lab Experiment



- Unpredictability

$$U = \frac{1}{N_s \binom{N_w}{2}} \sum_{i=1}^{N_s} \sum_{j=1}^{N_w} \sum_{k=j+1}^{N_w} |m_{i,j} - m_{i,k}|$$

Music Lab Experiment

Sensible result:

- Stronger social signal leads to greater following and greater inequality.

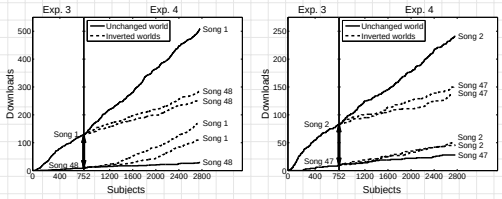
Peculiar result:

- Stronger social signal leads to greater unpredictability.

Very peculiar observation:

- The most unequal distributions would suggest the greatest variation in underlying 'quality.'
- But success may be due to social construction through following. (so let's tell a story... [7, 8])

Music Lab Experiment—Sneakiness



- Inversion of download count
- The pretend rich get richer ...
- ... but at a slower rate

Final words:

Modern science in three steps:

1. Find interesting/meaningful/important phenomena involving spectacular amounts of data.
2. Describe what you see.
3. Explain it.

Next Semester

For your consideration:

Spring 2011: Complex Networks (CSYS/MATH 303)

- Branching networks (rivers, cardiovascular systems)
- Redistribution networks (airlines, post)
- Structure detection for complex systems
- Contagion
- Random networks-arama
- Distributed Search
- Organizational networks
- Deeper investigations of scale-free networks
- and more...

References I

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Stardom and talent.
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pdf (⊞)

[2] M. Balinski and R. Laraki.
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[3] I. D. Chase, C. Tovey, D. Spangler-Martin, and M. Manfredonia.
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[4] P. Laureti, L. Moret, and Y.-C. Zhang.
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[5] S. Rosen.
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[6] M. J. Salganik, P. S. Dodds, and D. J. Watts.
An experimental study of inequality and unpredictability in an artificial cultural market.
Science, 311:854–856, 2006. pdf (⊞)

[7] C. R. Sunstein.
Infotopia: How many minds produce knowledge.
Oxford University Press, New York, 2006.

References III

[8] N. N. Taleb.
The Black Swan.
Random House, New York, 2007.